The recommendation in the product line configuration process

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In Product Line Engineering (PLE), product configuration describes the process of developing a product according to user requirements, by reuse from a Product Line model (PLM). The problem is that there are so many products in a PL that it is impossible to specify all of them explicitly. Then, when a user makes a decision (e.g. require or reject a reusable artifact), this can be contradictory with former decisions. Thus, the user will be confused and she/he will eventually abandon the configuration process. Consequently, it's crucial to guide the user by combining recommendation and configuration in the PL configuration process.

Recommendation helps users to identify relevant products according to their requirements which are elicited by observing purchase habits, features of products formerly acquired, etc. Several recommendation techniques already exist [1]. Many of these techniques are made for simple products and are not adapted to complex systems such as product lines or configurable software.

Our research goal is to help user to make his choice in a dynamic way by combining recommendation and configuration. This aim to inform the user in real time about possible/unattainable features according to her/his choices, and to suggest decision by reasoning with known configurations.

Thus, the main objective of our research goal is to answer the following research question:

How to combine the recommendation and the configuration in a product line?

In addition, another problem arises: at which configuration process level the recommendation should be applied?

In order to achieve our research goal, we are led to study and experiment the different recommendation techniques by exploring the limits and interests of each one. This study allows adapting these techniques to the PL configuration process.

The idea of our approach is to recommend only partial configurations that are valid with respect to the PL constraints, and satisfy the requirements that the user has already specified.

Our approach consists in intertwining recommendation and configuration activities in an iterative way. At each iteration (i) a series of decisions is offered to the user, (ii) the user makes choices, (iii) testing the user partial configuration, (iv) recommendation (v) configuration and constraint propagation, (vi) final decision.

At the beginning of our research, our work was started with an "a priori configuration approach" by focusing on a pack of features. This is called a "partial configuration". After checking that the partial configuration is correct and if the number of candidate products is too high for manual selection, then recommendation can be used to help the user make decisions for the next pack of features. The recommendation for the next pack of features is done under the form of a list of partial configurations ordered from the most recommended to the least recommended. Then, the user selects from the list according to her/his requirements. Next, the process is repeated at each cycle until the user decides to stop.

There are several recommendation techniques that can be applied. Among these techniques, we have started our research work by handling the content based recommendation method [5] which is based on textual data and it treats the recommendation problem as a search for related items [1]. Content based recommendation technique uses the definition of existing products, which are defined as a combination of features, to support recommendation.

In the literature, there are several recommendation techniques. We distinguish techniques that are used for simple product catalogs. The "content based" filtering [5] makes recommendations from products that the user has chosen, while the "collaborative" filtering [3] makes recommendations from products that were purchased from other users.

On the other hand, there is recommendation techniques used for complex products like the "constraint based" recommendation [2]. It is defined as a constraint satisfaction problem (CSP) [4]. This recommendation technique provides a solution which is consistent with the PL constraints and satisfying the user requirements. Constraint based recommenders provide explanations for inconsistent requirements [2] such that the calculation of recommendation becomes possible.

The major goal for future work is to experiment the different recommendation techniques and adapt them to our problem. In addition, we intend to extend our approach by defining the level of recommendation. Indeed, the recommendation should be applied, first, on the order of features among which the user selects a partial configuration. Secondly, the recommendation should be applied on the features selection as has been shown in our approach.

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